



COSMOS UC San Diego

California State Summer School for Mathematics and Science 

A RESIDENTIAL ACADEMIC EXPERIENCE FOR TALENTED HIGH SCHOOL STUDENTS AT UC SAN DIEGO

Week 3 Newsletter



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CLOSING DAY!

On Saturday, August 6th, students will present their final projects. Please plan to arrive at **8:30am to Warren Mall**. You will be escorted to your student's cluster project location where presentations will be from 9-10:15 am. Following the presentations will be the COSMOS Awards Ceremony at 10:30am. Students will be presented with their Completion Certificates and special awards. We encourage friends and family to come see all of the hard work that the student have been putting in during their month at COSMOS!

After the Awards Ceremony, we ask that families start heading back to the Eleanor Roosevelt College (ERC) residential halls to pick up their belongings and check-out. This means that all students should be packed prior to the Research Expo and have their keys and meal cards ready to be turned in. If your student has lost their key(s), it is a \$155 expense per set of keys and this must be paid at the time of check-out if not before. Broken keys are free to replace.

Families should park at the Gilman Parking structure near the Price Center. **Do not use the 9500 Gilman Dr. address in your navigation system-it will take you to our central mail processing!** Families can park in Gilman for the Research Expo and Awards Ceremony then drive to the Pangea Parking Structure to pick-up their student's belongings and check-out. All students **MUST** be checked out by 1pm.



Closing Day Driving Directions



Getting to GILMAN PARKING STRUCTURE

1. Exit La Jolla Village Drive from the I-5 S and head west to turn onto La Jolla Village Drive.
2. Turn right onto Villa La Jolla Drive.
3. Continue straight past Gilman Drive into Gilman Parking structure.

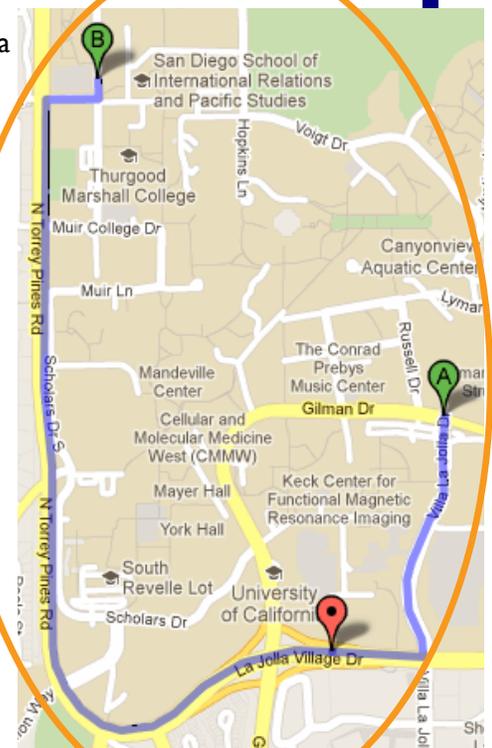
(Walking) From GILMAN PARKING STRUCTURE to WARREN MALL

1. Head NORTH from the Gilman Parking Structure on Russell Lane. Look for COSMOS signs that will be along the way to Warren Mall from Gilman parking structure.
2. Continue Past Matthews Ln. Walk Straight.
3. Turn Left upon arriving in Warren Mall.
4. Closing Ceremony will take place in Warren Mall, directly in front of

(Driving) From GILMAN PARKING STRUCTURE to PANGEA PARKING LOT

1. Head South on Villa La Jolla Drive.
2. Turn right onto La Jolla Village Drive
3. Continue straight onto N Torrey Pines Road.
4. Turn right onto Pangea Drive.
5. Pangea Parking lot will be on your left.

*NOTE: Parking is free on weekends unless otherwise noted.



DISCOVERY LECTURE SERIES

“New Medicines from the Sea: Past, Present & Future”



This week's discovery lecture featured Dr. Paul Jensen, a research microbiologist from the Scripps Institute of Oceanography. His research group addresses fundamental questions related to the diversity and distributions of bacteria in the marine environment while targeting taxa that produce biologically active secondary metabolites. In his lecture, Dr. Jensen started off with a history

of antibiotics. Prior to the discovery of Penicillin, there was no effective treatment for infections. He also went over how the molecules we find in nature evolve over many years and so many biologists are turning to the ocean as a new source of antibiotics and other medications.

The early pioneers in researching what secrets the oceans hold for medicinal purposes were typically organic chemists with an interest in marine science. They collected sponges, urchins, crustaceans, and sea squirts. These are a combination of soft bodied creatures and hard bodied creatures. When structural defenses are lacking, many sea creatures produce chemical defenses, which is of great interest to many organic chemists. In the early days, efforts were focused on those organisms that are most conspicuous and easily collected. Many unique compounds were found, such as highly halogenated terpenes from red seaweeds. Dr. Jensen then told the students about several very successful companies such as PharmaMar, SeaPharm, Oceanyx, and Sirenas. He encouraged them to seek out internships when they got their undergrad if any of them were interested in research such as this.



WOMEN IN STEM

The academic enrichment session this week, titled Women in STEM, featured Dr. Gabriele Wienhausen, Dr. Ebonee Williams, Maysoon Dong, and Elide Pantoli. Dr. Wienhausen is the Faculty Director of the Teaching and Learning Commons at UCSD as well as Faculty in the Division of Biological Sciences. Dr. Williams is the Director of the Gordon Engineering Leadership Center at UCSD. Elide is a graduate student of Structural Engineering and Maysoon is the Assistant Director of COSMOS.

It was very inspiring to see many young ladies join the session and share their experiences and concerns. The panel members were able to describe their unique situations in having to deal with being women in male dominated fields. The students asked a lot of great questions and shared their own experiences. Everyone was encouraged to find their true passion, whether it was science or engineering or some other discipline, and create support systems for each other to facilitate success.



RESIDENTIAL LIFE

There is so much we would like to share with you about your students' lives and progress here at COSMOS. The number one lesson students have been working on has been responsibility. Wednesday night the boys had an unfortunate experience of someone within the program pulling the fire alarm and, unfortunately, no one took responsibility for this action. This incident brought to light a variety of other infractions that had occurred such as not wearing proper identification, coming to classes late, staying up after lights out, and the like. Therefore the rights of privilege that had been given needed to be withheld.



Though of course simple compliance makes our jobs easier, I personally am rather pleased at the opportunity this turn of events has caused. Great conversations with individual and groups of students have led to the adoption of the notion that all should "see something, say something, do something". When students see other students eating breakfast too late meaning they will be late for class, they can say, "Let's get going". When leaving their suite and they see the back door left open they can lock it themselves even if they aren't the ones who opened it. When they see a student nodding off in class they can tap them awake and later remind them to go to bed on time. We are all in this together. These types of lessons are hard to learn in high school, but in this residential pre-college setting it has given these students real time examples to see Community in action

towards a common goal... getting their boundaries re-extended.



Regardless of the boundaries, everyone has been as busy as they want to be outside of class. At the College Success program the Admissions and College representatives stressed this importance of investigating your choices of universities thoroughly. We've been pleasantly surprised by the dozens of students who get up early with a buddy to run around the campus. Other lessons learned have been less theoretical and more fun. Taylor became a star at cheering for the sharks from the sidelines. Priyan connected to a fortunate debt. Everyone saw the magical sunset of La Jolla from the side of the warm waters. Chris tried to dig his way to another cluster. Kevin assisted the masses with their smores by hailing fire. Dax made a puzzling minion discovery. Agustin worked to master his skills with apples. Students who did



not go away during Family Weekend enjoyed a fun filled trip to Balboa Park which is over 2 times as large as NYC Central Park. They were also able to do egg roulette, make gingerbread house, be crafty, and just dance. The rest of the week included Casino night, bonfire, positive body image, pool night, gender

fishbowl, planting succulents and more.

We must forewarn you that this last week is often a time when you will not hear much from your student. They are not only busy getting ready for their presentations and projects, but they are also already preparing to shed tears over leaving one another. Students will put on a Talent Show, attend a fun filled carnival, have a yearbook party, and experience one last COSMOS dance, just to name a few events. Though UCSD COSMOS 2016 is coming to an end, there is a lot of fun in store to make the students' experiences as memorable and well balanced as possible.



CLUSTER 1: COMPUTERS IN EVERYDAY LIFE



Cluster 1: <http://ucsdcosmoscluster1-2016.blogspot.com/>

Late last week, we learned about circuits to prepare us for the Arduino labs we would be doing this week. We also finished up our Scribbler Maze lab. There were two challenges: traverse the maze using the infrared sensors to allow the Scribbler to find its way out and find the way out using the camera and image processing on directional arrows. Jeffrey and Josh had the fastest time finding the way out using only the sensors. Colin and Eric had the quickest time using the arrow clues leading the Scribbler out.

On Monday, our guest lecturer was Christine Alvarado from the CSE department. She told us about picobots – simulated robots that are programmed using state machines. It can only sense things directly to the north, east, west and south. Therefore it's coded by sequences which identify where it can and cannot move in those four directions. We got an opportunity to program the picobots through various mazes. With our experience with Scribblers and traversing a maze, we had some ideas on how to tackle the challenge.

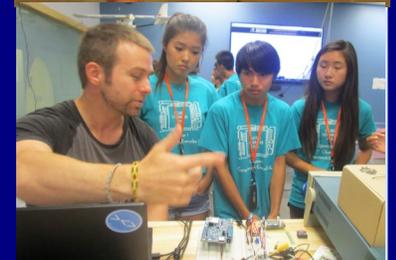
Tuesday in lab we finished up our musical instrument Arduino project. We became adept at circuits and got some new parts that we could include – like push buttons, speakers, proximity sensors and light sensors. You can see videos of us playing our instruments on our blog (<http://ucsdcosmoscluster1-2016.blogspot.com/>). The top musical instrument projects were made by Arjun and Jeffrey, and Nathan and Annie C.

Wednesday morning started with a guest lecture from Professor Tom Bewley. He runs the robotics lab at UCSD. One of his areas of research is feedback control. If you try to balance a pool cue stick upright in your hand, you move back and forth in an attempt to keep it standing up – that's using feedback to make adjustments. One project he spoke about was a self-righting mobile inverted pendulum (MiP). It originally started as a final exam problem on a test. After the class, so some students wanted to not just do the theory of it, but put it in action. Once they got it working and did more work, they realized it would make a fun toy and so they went to Wowee to pitch their idea. Now, you can get it at Best Buy, Target, and Amazon. It was in the "swag bag" at the Grammy's a few years ago. Here's a link to see it in action - https://www.youtube.com/watch?v=zTHp_GX2uOc. He also shared other robots he's worked on such as ones that go up and down stairs, pick up and throw balls, ones that bounce to get around and one that we can't even share publicly!

Later, some of the students from the Explorers for Engineering (E4E) lab came to talk about their projects. Curt (our faculty) and Ryan Kastner (who spoke to us earlier) are co-directors of E4E. We got to see the actual work they are doing with echolocation, radio collar trackers, underwater 3-D mapping and 3-D reconstructions using virtual reality – just to name a few! The students gave us great insight to their experience and projects.

In the afternoon, we began working on our walking Arduino robot. Each team has a different idea on how to get theirs to move around the room. We can use Kinex, popsicle sticks, and zip ties. We will be able to 3D print parts we need for it. It's been a challenge, but a lot of fun and one we are facing head-on. We'll present our walking robots on Friday.

We'll finish off the week with a visit to CallIT2, learn about two's complement and finish our walking Arduino robot. It's been a busy and challenging week. We're going to make the best of the final week of COSMOS!



CLUSTER 2: ENGINEERING DESIGN AND CONTROL OF KINETIC SCULPTURES

Cluster 2: <https://sites.google.com/a/eng.ucsd.edu/kinetic-sculpt/home/teams>

Daily life this week has been a balance of lectures, designs, tests, risk-reductions, and fabrication. Dr. Delson and Dr. de Callafon have been increasing the technical components and diving into more advanced topics. Some students saw derivations and calculus for the first time as they learned how sine and cosine functions and dynamics of oscillations are intricately related. Students were also introduced to Degrees of Freedom and good designs for bearings. This week, students continue to work on their minisculptures, risk reductions, and team webpages located here: <https://sites.google.com/a/eng.ucsd.edu/kinetic-sculpt/home/teams>. We also had a wonderful field trip to Solar Turbines and Belmont Park on Wednesday.

Monday During Dr. Nelson's lecture, we learned about the utilization of velocity and force, as well as the relationship between the two. We were given a sea-saw analogy in which we learned that the greater the mechanical advantage we were obtained, the less advantage in velocity we had. In addition, we also listened to his lecture about bearings, in which we learned about different levels of friction and precision. Through this lecture, we are now able to apply such knowledge to our sculpture project, as we have started 3D printing parts and incorporating motors to our structures. -Ashley

Tuesday For the past two days of this week, our cluster has been starting on our kinetic sculptures for our final project. The project requires every group to design and build a kinetic sculpture out of PVC pipes, tracks, connectors, and objects that we create in Inventor and 3D print or Lasercamm. We started off on Monday by taking a sculpture that we created at the end of the previous week and rearranging objects into the designs we want. It was mostly a day to work on revising our designs and picturing how we would be able to implement them into one project. On Tuesday, we continued to work on our sculptures. Some groups started to code and create robots for parts of their sculpture. In addition, we listened to a lecture about the degrees of freedom of an object as well as good ways to use bearings. It has been a rather busy two days, to be followed to a field trip on Wednesday and a risk reduction test for our sculptures on Thursday. I, personally, am looking forward to delving deeper into these topics and seeing how our sculpture will turn out in the end. -Erica

Wednesday Today was a fun-filled day of activities. We went on a field trip to the company Solar Turbines in the morning and spent time in the afternoon at Belmont Park. At Solar Turbines, those of us who didn't wear long pants because it was a hot day weren't able to go on the tour. Therefore, we sat through a couple of presentations in the conference room regarding some of the work they do at the company. They mainly focused on the mechanical and engineering design portions of their work. After eating our boxed lunches, we took the bus to Belmont Park! Everyone had a great time on the rides, especially on the Big Dipper, which was a roller coaster made primarily out of wood... quite uncomfortable but really fun! A group of us also enjoyed fattening portions of ice cream from Sweet Shoppe before we left. Overall, it was a productive yet relaxing day. -Tiffany

On Wednesday the twenty seventh at 9:15 cluster two boarded a bus to a Solar Turbines faculty. "Headquartered in San Diego, California, USA, Solar Turbines Incorporated, a subsidiary of Caterpillar Inc., is one of the world's leading manufacturers of industrial gas turbines, with more than 15,000 units and over 2 billion operating hours in over 100 countries" (Caterpillar | Solar Turbines). A group of student were able to get the tour of the floor faulties and assembly area. Whereas a majority of the class were given an oral presentation. After learning about the machine's, control and packaging of the turbines our class boarded the bus again. Our afternoon was spent at Belmont park gaining first hand experience with kinetic sculptures. Your cluster spent quality bonding time observing the effect of kinetic machines and phics by riding multiple roller coaster and amusement park rides. -Estelle





CLUSTER 3: LIVING OCEANS AND GLOBAL CLIMATE CHANGE

It's hard to believe that we are at the end of week three! At this point, projects are in full swing, and all of us are getting the hang of lectures. As we begin the mad dash to complete our projects and prepare presentations, I'll let the kids say more!



"Over the past few days we have broken up into groups of four and worked on 5 different projects. Every Tuesday and Thursday afternoon we work with Lai, Chris, Colleen, or Matt and go in depth in our projects by doing different experiments. In the brown carbon group we have tested the air for aerosols by the beach, and three other places on campus. The machine we use takes in surrounding particles found in the air and measures the flow of darker particles. We have started to make the presentation that will be given at the end of COSMOS to our friends and family. These groups of four have also started on making scientific posters that show the progress we have made." – Madeleine Wong



"After two and a half weeks at COSMOS, students progressed further into their projects and started to know exactly what they were doing. The Bluetooth

coulometer group could now perform titrations with ease and gathered data more efficiently. With the help of an electric current, students used electrons to neutralize acid and calculated the concentration of the acid used. They still needed to incorporate a way to control the titration remotely with Bluetooth, but after they do so they will gather all the data from the month and form a report to present to parents at the end of the month." – Andy Zhou



"On Friday, we started the day by going to SIO. We learned about adaptations that created different marine species, including sharks and our great ancestors, the lungfish! We looked at different ecosystems and stressors they undergo. At the end of his class, we saw footage detailing the process of tagging sharks for research. In Dr. Pomeroy's class, we learned more about photochemical smog and completed an experiment to look into how aerosols affect the way we see sunlight." – Holly Helmuth-Malone



"On Monday, we all went to Lai's class down at SIO again and went down to the tide pools again. It was even cooler than the first time because we applied our knowledge of the rocky intertidal and the creatures that lived there. It was really fun to see them in person. We even saw a sea hate ink! After that, we attended lecture and went to go eat. Then we went down to Skip's class at NSB where we learned about ocean acidification and the chemistry behind it, including pH and alkalinity. We did an experiment where we created a buffer solution in a flask that acted like the ocean in terms of its pH." – Aanchal Garg



"Wednesday, we headed over to SIO for another class with Dr. Lai. We learned about the different zones of the ocean, as well as the different types of creatures that occupy them. Then we dissected various types of rockfish and other freshwater creatures to get a better idea of their physiology. In the afternoon, we had a lecture by Robert Pomeroy and participated in a titration lab. Overall, it was a very informative day of classes." – Emma Auerbach

CLUSTER 4: WHEN DISASTER STRIKES: EARTHQUAKE ENGINEERING

So much to do and so little time. As we conclude an exciting week three of COSMOS 2016, our eight project groups are moving forward with structure testing as efficiently as possible with the knowledge that their poster presentation is just around the corner. They continued to refine the retrofitting on their structures, with the hope that additional testing and analysis provide data showing that they have successfully mitigated the potentially damaging seismic vibrations. Our cluster students also participated in many other exciting activities during the week such as cluster exploration and the weekly Discovery Lecture.



Week 3 began with students receiving valuable lectures on how certain types of buildings react to seismic forces, and the nature of soil behavior on slopes. We watched spon-

aneous videos of recent earthquakes, thanks to social media, showing actual damage happening from street level. The students are beginning to find logic in which techniques are most effective in retrofitting existing buildings to make them safer. Those ideas translate into their project design, with great attention given to the available materials in their assigned geographic regions. There is great anticipation when the students test their structures! Some fair very well and others still require further research and design innovation. They will continue testing through next Tuesday before they buckle down to produce their poster and ready their presentation.

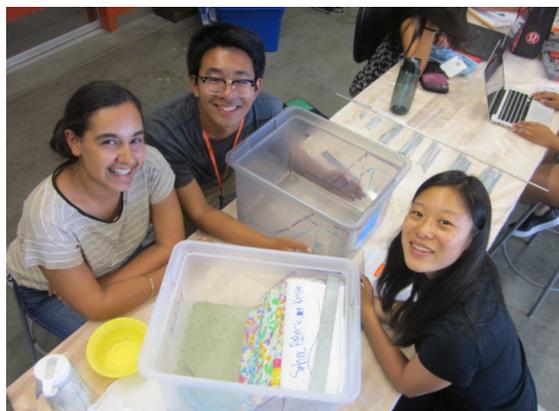
We also enjoyed several ventures out of our lab this week. We began by touring the campus CalTrans SRMD facility. You may enjoy reading more about it at this link: <http://structures.ucsd.edu/node/62>.

The Seismic Response Modification Devices are used to test structures such as highway bridge columns under earthquake stresses. Later we bussed to the San Diego Emergency Services office, receiving a tour detailing the



responsibilities of personnel during fires, earthquakes, and other disasters. The building itself has been fitted with base isolation devices, which the students saw from below ground level. The afternoon concluded with an amazing tour of the Englekirk Center and the UCSD NEES shake table, a full scale earthquake shake table capable of testing structures up to seven stories tall. It is located approximately eight miles northeast of the UCSD campus. Students heard about the history of the table, watched videos of past testing, and then went underground to see the actuators and systems that operate the table. You may enjoy watching their testing videos at this link: <http://nees.ucsd.edu/>. It was truly special to see and learn about such a world-class facility.

We press on towards the completion of our projects, and the eventual production of some terrific posters and professional presentations. Students are also receiving instruction in effective communication of their findings. The students look forward to showing off their hard work to you next week!



<https://sites.google.com/a/eng.ucsd.edu/ucsd-cosmos-cluster-4-2016/>



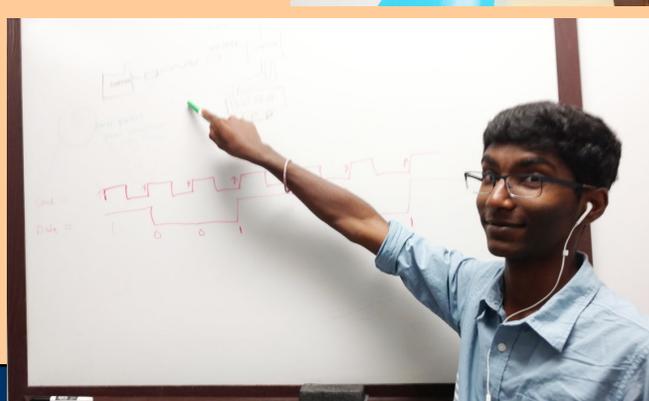
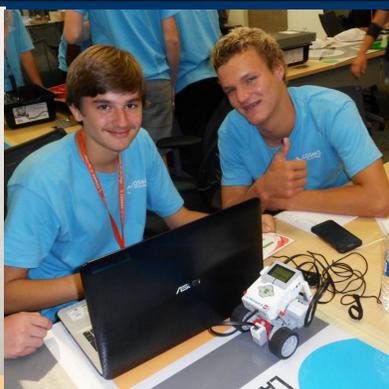
CLUSTER 5: FROM LASERS TO LCDS: LIGHT AT WORK

After Parents' Weekend, students returned to the COSMOS UC San Diego campus with renewed enthusiasm for their cluster. We started off the week with a lecture from Dr. Tu about the latest developments in plasma lasers able to emit light in the deep (DUV) and extreme ultra-violet (EUV) ranges. After lecture, we returned to the lab where student teams wrote proposals for their final projects. Our Final projects this year, involve in-depth investigations exploring the topics of laser seismography, comparing dye-sensitized organic solar cells, atmospheric effects affecting optical free space communication, creating improved optical polymer lens, and using lasers to create electronic music.

The laser seismography group is building a device that uses a fiber optics cable as a free-swinging pendulum coupled with a photodiode in the base to detect possible seismic activity and display the output on an oscilloscope. The solar cell team will test different organic compounds and their capacity to efficiently convert the sun's energy into power. The optical free space communication group will test the effect of different atmospheric conditions on laser signal quality. The optical polymer lens group will be experimenting with innovative techniques to make larger inexpensive high quality plastic lens with magnifications comparable to quality direct-light microscopes. Our final group is programming computers to translate the 'laser harp' operator's interaction with its multiple beams into electronic music. Cluster members are feverishly working on their respective projects to ensure that they will be ready to share their exciting findings at the end of the COSMOS summer session.

This week's Discovery Lecture how given by Dr. Paul Jensen from Scripps Institute of Oceanography, a department of UC San Diego. Dr. Jensen spoke about "New Medicines from the Sea: Past, Present & Future" and about his work to find marine bacteria, which produce biologically active compounds that can be a resource for drug discovery. Tuesday afternoon, we toured Cymer, Inc. the industry leader in making the light-sources used in creating microchips. The highlight of the tour was being the same room with one of Cymer's EUV light-sources that is as big as a car! Later, a panel of three engineers shared with the students their personal experiences, insights and advice for working in the STEM fields. Students then formed five teams and attempted to program their LEGO robot to navigated a large diagram-map of the CYMER campus.

This week, we were also able to visit several optics labs in the Jacobs Engineering Building and were fortunate to hear about some of the interesting research and development that was occurring there.





CLUSTER 6: BIODIESEL FROM RENEWABLE SOURCES

On Thursday morning, Mr. Towler led our cluster to Center Hall for cluster presentations. The professors from clusters 2, 3, 6, 4, and 1 told us all about their projects and what was going on during class. After the presentations, we headed over to the fourth floor of Bonner Hall to get inspiration for our presentation posters. For the rest of the morning, Mr. Towler talked about our ethics essay, which I'm having so much fun writing, and our projects. After lunch at 64 degrees, we went to York Hall and split into our groups for our final project. My afternoon consisted of waiting for my polyol to separate from my aqueous layer and stressing over the quiz Jack was going to give us. Overall, it wasn't a bad day.—**Emily Qi**



On Friday, Dr. Pomeroy lectured on the different forms of energy and cleared up misconceptions on the difference between heat and temperature. We reviewed calorimetry calculations, conversions between different units, and enthalpies. During the afternoon lab, the cluster split into several groups, and each group analyzed their biodiesel with various instruments in the lab. My lab partner and I used a bomb calorimeter to find the energy that our biodiesel produces when combusted. Several thick metal containers compose a bomb calorimeter. Two wires connected to electrodes lightly touch the surface of a small cup with one gram of the sample. The wires deliver the electrical charge that heats up the sample, which transfers its heat to two liters of water that surround the container. As the calorimeter runs for 500 seconds, a computer takes a live feed of the water temperature in the calorimeter. We use a calorimeter constant that we calculated from running a tablet of benzoic acid through the calorimeter to calculate

the total energy that the biodiesel produced.—**Garrett Ma**

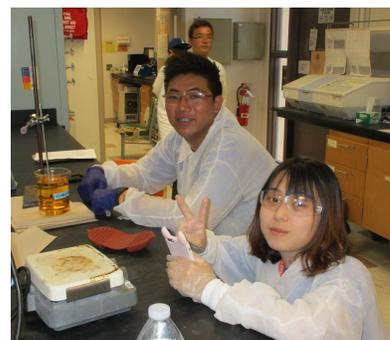


Monday started in the Natural Sciences Building with a three-hour lecture by Dr. Pomeroy. As every Monday, Wednesday, and Friday goes, it was an interactive lecture of just us twenty students, and we learned more and more about enthalpy change, calorimetry, and how more chemical and physical properties of our biodiesel can be analyzed. The subject, though complicated, was helpfully made more clear through Dr. Pomeroy's relaxed presence in the classroom setting that does not express any feelings of intimidation. After we enjoyed lunch at 64 Degrees, we learned more about how to analyze our biodiesel and the specific properties our biodiesel holds. My lab partner and I learned that our biodiesel would be compatible in the tank of an airplane in the future because its cloud point (temperature point at which the fuel starts to solidify) is relatively low at -2 degrees Celcius, which was great news to us! Great day overall.—**Hadley Klein**



Tuesday began with a discovery lecture on the medicinal applications present in the chemical defenses of certain marine organisms. In other words, this lecture

taught us that from these organisms, which include the sponge and the sea squirt, we can derive many unique chemical compounds, and some of these compounds have antibiotic and/or healing properties that can be used to further drug research. After lunch and our daily set of ping pong skirmishes at 64 degrees, we went back to York Hall to continue our research and data collection for our final projects. Our group's project is creating shoe foam out of Algae and Jatropha oil. In order to do this, we must first synthesize and purify polyol (long chain hydrocarbons with multiple hydroxyl groups) from the oils, which is what we have been doing the first two weeks. Today, we finished purifying our polyol and tested it with an FTIR machine for authenticity. Thursday, we'll get to start making the foam, and I'm excited to get back to work in the lab with Lauren, Andrew, and Saehui.—**Jaeyoung Choi**



Our third Wednesday began with a lecture from Dr. Pomeroy as usual. By this point in COSMOS, we were done with learning about the concepts needed to understand the properties of biodiesel. So, we moved on to discover the instrumental techniques. Our focus today was on gas chromatography. After a delicious lunch at 64 degrees, we headed on to the lab at York Hall. Like previous lab days, we separated into lab groups and continued on our biodiesel testing procedures. Our group used the FTIR instrument, which uses infrared radiation, to test our biodiesel. After testing, we created an excel spreadsheet to record the data. We were amazed at how sophisticated the instruments were. I am looking forward to the remaining days with my cluster! - **Lauren Park**

CLUSTER 7: BIOENGINEERING/MECHANICAL ENGINEERING: THE AMAZING RED BLOOD CELL



Another eventful week for Cluster 7!! Labs, field-trips, essays and boba-tea. Over the past week, we finished our ethics essays, began learning about Engineering and material science and visited 2 of the most innovative institutions in the world for Bioengineering. Over the weekend many students reconnected with family to tell them about all the wonderful experiences they have been having at COSMOS. This week our focus has been trying to understand Tensegrity! What's that?

JCVI—On Thursday, we had an opportunity to visit the J. Craig Venter Institute (JCVI). Venter is credited with sequencing the entire human genome in 2000 using a method called “shotgun sequencing.” JCVI is a world class research institution, not only mapping the diversity of the human genome but attempting to sequence the DNA of all marine microbes, reverse engineering the Minimal Cell (the first artificial life form), characterizing the genomes of unknown organisms, the human microbiome and even reverse engineering bacteria to reclaim sewage to solve sanitation issues and provide clean water around the world. After a long walk across campus... students learned about novel methods (RNAseq) for sequencing the genomes of microbes and had an opportunity to visit labs talk to scientists.

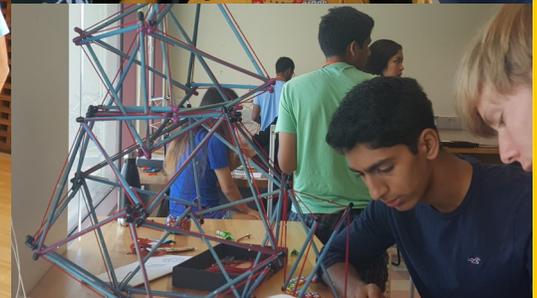
Ghost Membranes and RBC Protein Identification—On Friday, we conducted our last wet-lab before we move into the engineering phase of our projects. Students learned about how to identify proteins extracted from RBC membranes using antibodies in a technique called SDS Page (immunoblotting)...more commonly called Western blotting. Students also did a peer critique of lab notebooks and learned a bit about keeping good records and data analysis for labs.

Lectures and Labs—On Monday, Mauricio de Oliveria introduced us to the concept of tensegrity and its practical applica-

tions in bioengineering and modeling the dynamic behavior of complex systems. Students built both simple and complex tensegrity models using sticks and strings. These floating geometric forms use compression and tension to stabilize themselves. By building these models we can test the structural integrity of these shapes and developing a better understanding of behaviors at the micro and macro level. On Wednesday, Paul our TA gave an Introduction to Material Science 101. He also discussed his work with NASA on the Superball Project. Paul reviewed Hooke's Law, calculating tension and stiffness of materials as well as Young's Modulus. Students tested these concepts in our afternoon lab.

Illumina—Illumina is a global company specializing in the analysis of genetic variation and gene function through high throughput sequencing. They are fueling groundbreaking advancements in life science research, clinical translational, consumer genomics, and molecular diagnostics. On Tuesday afternoon, we took a tour of whole genome sequencers and DNA synthesizers at Illumina which was an amazing experience bordering on science fiction. State of the art labs, liquid handling robots and rapid prototyping of microfluidic glass slides. Later, we attended a career opportunities panel where Illumina employees working in Genetic Counseling, Industrial Hygiene, Applied Mathematics, Validation Engineering, Technical Support for Instrumentation and even the VP of Acquisitions and Mergers discussed their career journeys.

All in all, an intense week for Cluster 7!! Tune in next week.



CLUSTER 8: TISSUE ENGINEERING AND REGENERATIVE MEDICINE

Week two ended with super summary lecture from Dr. Gaetani. He helped us review all of the material from our lectures and discussions and answered our extensive array of questions. Dr. Sah introduced us to proper experimental design so we were fully equipped to delve into project planning on Friday afternoon. Each project group of three students was able to develop a title, summarize background information, propose a study design, and plan appropriate statistical analysis.

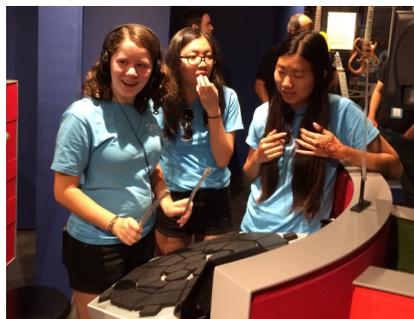
Week three began as we completed our planning phase of our work. After two days of researching, planning, brainstorming, and support from our revered professors Dr. Sah and Dr. Gaetani and our cherished TA's, Erica, Rebecca and Neha, everyone was prepared to begin the much anticipated projects. Briefly the groups will be examining the effect of cartilage matrix on compaction and remodeling of collagen, cartilage tissue engineering by compaction, the relationship of hyaluronic acid (HA) and cartilage particles on chondrocyte growth and extracellular matrix (ECM) retention, cardiac ECM hydrogel stiffness as it relates to cardiac progenitor cell viability, cardiac stem cell viability in MeHA-UV cross-linked gels, and cardiac stem cell growth in spheroids with a variety of ECM's. In the lab, tissues are being processed, gels formed, cells cultured, and materials are being prepared and tested. After an intense week in the lab our projects are underway and we eagerly await the results in a few days.

Dr. Paul Jensen, from Scripps Institution of Oceanography, was our speaker for our Discovery Lecture this week. His research goal is to find microbes which produce natural products that can be used as new medicine, a topic that our cluster found intriguing! In Cluster Explorations, it was all about cluster pride, as Dr. Sah presented to all of COSMOS. He spoke about what we have been doing and a brief glimpse into the GR8 projects underway. Out of the lab and in science communications, we are working on creating posters, power points, and papers to document our projects and prepare for our upcoming presentations. Cluster 8 continues to be 'GR8' as we have acquired the knowledge and developed the discipline to plan and execute our projects.



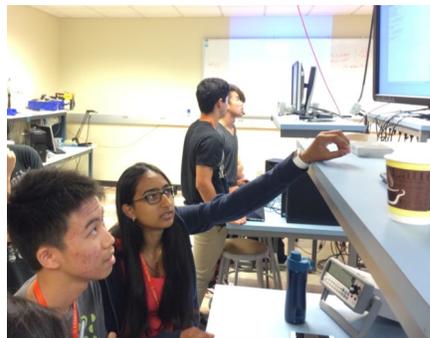
CLUSTER 9: MUSIC AND TECHNOLOGY

After spending nearly three weeks here at UC San Diego, living in dorms, waking up for class, living as an independent young adult has become routine. We have been getting accustomed to college-style classes, which are very different than high school classes. One main difference is that high school teachers take time to make sure students understand the material before moving on, whereas college professors expect students to be self-motivated to take the extra time to understand material on their own through study, or asking questions in class. We met our second professor, Shlomo, who is in the Music Department at UCSD and gave us an interesting lecture on the evolution of music.

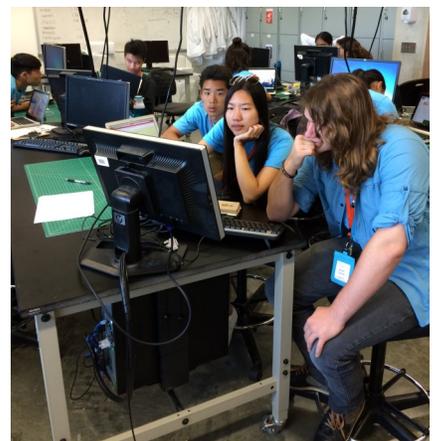


On Wednesday we took a field trip to the Museum of Making Music in Carlsbad, where we learned about the evolution of different types of music and instruments in the United States. The museum featured many different types of common instruments like pianos, saxophones, and trumpets, as well as more unknown instruments like the theremin and the steel lap guitar, which we were able to play in the museum ourselves. It was very interesting to learn how different styles of music such as jazz, ragtime, and rock n' roll evolved in the U.S., and were related to various social and cultural events of

the time such as Prohibition and WWII.



This week, we have started to work on our final projects. We formed groups of three based on our strengths and interests to create projects of our own design using the programs and hardware we have been learning to work with in class thus far. In the beginning of the week, groups did a lot of brainstorming to figure out if our project ideas were possible. Towards the end of the week, we began honing in on our ideas and created plans for our projects that can be completed in the short amount of time we have left in Cosmos. Every group has a project idea and outline ready and we have all begun working on the first steps of our project. The project ideas are diverse and incorporate everything we have used so far from programming to synthesizers to robots. All of our projects involve using microcontrollers (Arduinos and Raspberry Pis) and softwares (Pure Data and Python) to create the beautiful organization of sound known as music. We are working closely with our professors and TA's to bring our projects to fruition. We are excited to showcase our hard work on August 6th.





CASINO NIGHT



- Christopher Sweeten 7/25
- Anya Singhal 7/25
- Eugelyn Lopez 7/26
- Frederick Nitta 7/26

Happy Birthdays!



CASINO NIGHT

